CLOUD COMPUTING: AN INTRODUCTION FOR THE LAYPERSON

Charletta F. Gutierrez
College of Business and Management
Northeastern Illinois University, Chicago, IL 60625

ABSTRACT: Cloud computing has become the buzz word of the IT industry. Executives have been told it is the way to cut spending on IT. But what is all the hype about? Should we all be jumping onto the “cloud” bandwagon or is the cloud full of holes? This paper looks at the current literature on cloud computing to try to answer these and other questions for the IT executive, the typical manager or the layperson.

KEYWORDS: Cloud Computing, SaaS, PaaS, IaaS

1 INTRODUCTION

Over the last few years, cloud computing has been presented as the next big wave of computing. Even with the upturn in the economy in the last year or two, executives and managers must be on the lookout for ways to curb spending. One of the common targets is to reduce expenditures on Information Technology (IT) and computing in general. The last wave was the movement into outsourcing.

According to Klepper and Jones (1997), all senior IT executive must consider the outsourcing decision to help reduce IT costs. Thus, cloud computing will be the next big decision they must face in their quest for lowering the large expenses associated with IT. For many IT executives cloud computing is another form of outsourcing (Cloudtweaks, 2012; Dhar, 2012; Flinders, 2012; Janakiram, 2012). However Bias (2010) states, “Cloud computing is not about ‘outsourcing’, it’s about delivering self-service IT ‘at scale’ through automation.”

With the above being the case, it would be helpful to determine what cloud computing really is. What the proposed benefits to the organization are with moving to cloud computing and adversely what are the risks to the organization.

1.1 Cloud Computing Defined

Cloud computing has several definitions. According to Daley and Rudolph (2010), there are over 23 definitions of cloud computing to date, and these are only the documented definitions. In this paper, several different definitions are presented to give the reader different perspectives as to what cloud computing means to their organization. The most commonly cited definition is that of the National Institute of Standards and Technology (NIST), while it went through several iterations before settling on a final definition, “Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction,” (Mell & Grance, 2011). However, as definition is ambiguous, it was important to find a more “user friendly” definition. Thus, according to Shivakumar & Raju (2010), cloud computing can “roughly” be defined as “a simple style of computing in which massively scalable IT-enabled capabilities are delivered ‘as a service’ to multiple customers using Internet technologies.”

Cloud computing is defined by Vaquero, Rodero-Merino, Caceres & Lindner (2009) as “a large pool of easily usable and accessible virtualized resources.” They go on to state that “These resources can be dynamically reconfigured to adjust to a variable load,” (Vaquero, Rodero-Merino, Caceres & Lindner, 2009).

Another “narrow” definition is provided by Ward & Sipior (2010) with the help of Knorr & Gruman (2009, cited by Ward & Sipior in
“Cloud computing is an updated version of utility computing which includes virtual servers delivered over the Internet.” These same authors provide what they call a “broad” definition as “cloud computing encompasses any IT resources outside of the firewall including conventional outsourcing” (Ward & Sipior, 2010).

According to Janakiram (2012), cloud computing means different things to different people. For executives, it means cost cutting measures. To developers, it means web services, or reusable pieces of software code that can be invoked (or called) over the Internet. He goes on to state that IT professionals, including system administrators and managers understands that “cloud computing is all about the consolidation and outsourcing of the infrastructure.” (Janakiram, 2012). Ultimately, he defines cloud computing as “outsourcing your infrastructure and applications to run on a remote resource.” Thus, there is disagreement among experts concerning the term “outsourcing” when it comes to cloud computing.

Because of this disagreement, a further look into a comprehensive, user friendly definition of cloud computing is warranted. Cloud computing, according to Hurwitz, Kaufman & Halper (2012), is “a method of providing a set of shared computing resources that includes applications, computing, storage, networking, deployment, and development platforms as well as business processes.”

According to Lew Tucker, CTO of Cloud Computing at Sun Microsystems, “Cloud computing is not so much a definition of a single term as a trend in service delivery. It’s the movement of application services onto the Internet and the increases use of the Internet to access a variety of services traditionally originating from within a company’s data center,” (as cited in Creeger, 2009).

Foster, Zhao, Raicu & Lu (2008), after much research into the definition of cloud computing came up with one of their own. They propose that cloud computing is “a large-scale distributed computing paradigm that is driven by economies of scale, in which a pool of abstracted, virtualized, dynamically-scalable, managed computer power, storage, platforms, and services are delivered on demand to external customers over the Internet,” (Foster, Zhao, Raicu, & Lu, 2008). While this definition covers all aspects of cloud computing it may be conceptionally complex. Thus, a final, very simple explanation of cloud computing comes from von Solms & Viljoen (2012), “cloud computing is a computing model which allows one to access an IT service over a network, as or when it is needed, without worrying about the technical details of how the service is provided.”

With multiple definitions of cloud computing provided, the reader should be able to understand that there is not just one way of looking at cloud computing but multiple ways. How each organization interprets the definition will impact the overall decision of whether to invest in cloud computing.

1.2 Back to the Basics of the “Cloud”

Even though cloud computing is hyped up as being a new technology it has very sturdy roots in other computer technologies (Hayes, 2008; Srivastava & Kumar, 2011). Many believe it was first discussed way back in the 1960’s when John McCarthy (1961), predicted that computing would one day be ‘on demand’ like the public utilities. He also coined the term time-shared (Earnest, 2011). According to Hayes (2008), this led to the concept of the service bureaus and eventually the Internet. However, IBM started a service bureau almost 50 years before the service bureaus of the 1980’s sprung up. According to Sipplles (2011), as far back as 1932, IBM’s service bureau provided what they thought was “state-of-the-art data processing equipment included punched cards, sorters, and tabulators.”

According to Cusumano (2010), the next stage of cloud computing became application hosting. Application hosting was provided by what was termed in the 1980’s as application service providers (ASP). The ASPs provided a type of client-service outsourcing function. They would transfer the customers’ applications to an off-site data center. According to Kaplan (as cited by Kincora, n.d.), “since so many customer-specific applications were being run by one ASP, the ASPs couldn't provide much expertise in each application.” She continued on the same note to say that in-house expertise was still required by the customers, as the applications needed to be monitored (Kaplan as cited by Kincora, n.d.).
The Internet then became a link in the chain towards cloud computing. As a matter of fact, some of the definitions of cloud computing refer to the Internet as the cloud. It is true that without the introduction of the Internet, cloud computing would not exist, but the Internet is the enabler not the cloud itself. However, if one looks at many of the network design diagrams a cloud was drawn to represent the entrance into the Internet or the wide area network (WAN) provider’s network. This was to represent that the connections exist, but the organization does not know how the connections are made and where they travel. Thus, the diagram removes the details from the organization and they do not have control over what is in this arbitrary cloud.

Grid and utility computing came next. As a matter of fact, one of the initial definitions provided by whatis.com follows: “Cloud computing is simply a buzzword used to repackage grid computing and utility computing, both of which have existed for decades,” (Whatis.com, 2007). According to (Foster, Zhao, Raicu, & Lu, 2008), the term Grid computing was used to describe a type of computing where customers could request computing power on demand, reducing the need to high powered computers within their own organizations. With grid computing, a large task is divided up between many different systems, thus the answer to a complex question may be obtained faster. This is specific to grid computing and not a function of cloud computing. The problem exists with the usage of each technology because you may have a grid within a cloud or adversely a cloud within a grid. Furthermore (Sundaram, 2011), states that while the cloud is intended to allow the user to have access to various services without the high cost of investing in the underlying architecture, grid computing offers the user a similar facility for obtaining computing power, while, cloud computing isn’t restricted to just that. Thus, cloud computing may offer many different services, from web hosting, right down to desktop type applications like word processing (Sundaram, 2011).

Utility computing is also similar to cloud computing, however there are differences. As with grid computing you can have utility computing within the cloud and cloud computing within utility computing. Again, cloud computing offers many different services, while utility computing is more restrictive. Utility computing is the renting of computing resources such as hardware, software and event network bandwidth, on an as-needed, on-demand basis, similar to grid computing.

Thus, all of the above technologies are precursors to cloud computing and without them providing the groundwork, cloud computing may not exist as it does today.

2 CLOUD SERVICES

Cloud services are different for the organization that it is for the everyday consumer. Therefore a brief discussion of services provided for the different groups follows.

2.1 Non-IT Cloud Computing

Consumers, including school children, see cloud computing as applications that are readily available on the Internet. For example, Google Docs is used in many educational environments to allow school children to use applications and share documents no matter where they are accessing the data from. Furthermore, other consumers see cloud computing as an extension of their own hard drives and use it for the storage capabilities alone. Thus, to them it is defined as unlimited storage. Others still, use cloud backup services, again, using the storage capabilities of cloud providers like dropbox.com. Examples include all the current picture storage sites, like Flickr, Picasso, Photobucket and Shutterfly. But the cloud goes even further with the ability to use the photo editing software, like Pixlr. Fouquet, Niedermayer & Carle (2009), present a good argument for the use of on-demand bandwidth for video streaming. Thus, consumer may take advantage of this service when needed.

Consumers are even likely to think of cloud computing in terms of social media. That is, the ability to access their Facebook or LinkedIn pages anytime and anywhere. To many cloud computing is just webmail (Lin & Chen, 2012). Consumers with multiple devices use cloud services like iTunes and iCloud to synchronize all of their computing devices, this service is provided on a “personal cloud”. Another service to the individual consumer is that of calendaring and keeping schedules between all members of your family.
Cloud computing is inexpensive to home users because many of the popular applications are free and just require a consumer to create a login. Some of the most popular desktop applications include Google Docs, Office 365, ZoHo Office and Prezi. Prezi allows users to create and present professional looking presentations in just a few minutes. Thus, even though many consumers are not even aware of the definition of cloud computing they may be using the cloud every day!

2.2 Organizational Cloud Computing

For organizations cloud computing combines all the elements of hardware, software and service into one external environment (Shivakumar & Raju, 2010). The three most popular service models are defined as infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS) and software-as-a-service (SaaS). Organizations may use some or all of these services or more depending on their needs. As cloud computing is a shared environment, it must be able to exist in conjunction with the organizations internal systems and do this seamlessly.

IaaS provides access to a shared pool of resources that can be allocated to any application at any time. Thus, the organization is not required to manage a large data center and the hardware and software required to run it. According to Garrison, Kim & Wakefield (2012), the services available by the cloud provider are access to servers and the processing capability they provide, storage of data as well as replication, backup and archiving capabilities and connectivity domains such as firewalls and load balancing. These services are provided by a usage model.

PaaS is where the vendor provides the platform where the applications reside. This includes the development and deployment of any applications and services the organization wishes to implement, such as programming and middleware services (Garrison, Kim & Wakefield, 2012; Hurwitz, Kaufman & Halper, 2012). The platform provides a consistent set of well-tested development tools to improve the integration of the services (Hurwitz, Kaufman & Halper, 2012).

By far, SaaS is the most popular service model adopted by organizations. With SaaS organizations gain access to software applications that are part of the cloud provider’s inventory. The cloud provider has complete control over the licensing, capabilities, any updates and needed maintenance (Garrison, Kim & Wakefield, 2012). Additionally, may or may not be integrated with PaaS or IaaS services. These applications are run available through a simple web browser, thus the user does not need more than a thin client.

2.3 Characteristics of Cloud Computing

The discussion about cloud computing would not be complete without a discussion of the characteristics of cloud computing. Durkee (2010) provides a comprehensive list of what he calls are the “essential characteristics.” His list is provided below:

1. On-demand access
2. Elasticity
3. Pay-per-use
4. Connectivity
5. Resource pooling
6. Abstracted infrastructure
7. Little or no commitment

However, there are a few other essential characteristics that are not included in the above list. Examples of such characteristics include agility and flexibility, predictability, consistency, availability. However the most obvious characteristic missing from Durkee’s (2010) list is the security issue which will be addressed in the second on risks.

3 PUBLIC OR PRIVATE CLOUDS

A critical decision for organizations is whether they will implement a public or a private cloud or even some type of hybrid of the two. While there are similarities between these models there are also some telling differences.

3.1 Public Cloud

A public cloud, also referred to as a shared environment, provides services over the Internet from a remote site. The organization has no control when it comes to the underlying infrastructure nor the technologies used within the cloud. Nor does it want to. Thus, organizations
that decide on the public cloud model do not have to have any internal expertise as the public cloud is maintained and managed by the cloud provider. This model can be less expensive because manpower is one of the most costly resources to an organization. A public cloud is open to anyone that wants to access the resources provided (secure-24, n.d.). Furthermore, public clouds can be implemented with the pay-per-use model or in some cases it is free to the public (secure-24, n.d.).

3.2 Private Cloud

A private cloud, according to Hurwitz, Kaufman & Halper (2012), resides on a private network, usually behind the organization’s firewall. This gives the organization more control over its own data. This model also provides more security or at least the sense of security. The major downside of private cloud services is the cost. Many organizations move to cloud computing mainly for the lure of reducing the cost of IT expenditures. With the private cloud model this is not always the case. Furthermore, if your organization already has a huge investment in IT, then the private cloud model may be the most practical. However, there is another type of private cloud environment, this is where a commercial private cloud is actually located at the cloud providers site but provides a secure network connection to the customers’ existing IT resources (Hurwitz, Kaufman, & Halper, 2012). Thus, there are some clear advantages to private clouds. Specifically, security, ownership and accountability to name a few (Malcolm & Giunta, n.d.). Furthermore, with a private cloud the cloud provider custom designs the cloud for your particular business model. Another simplified way of describing a private cloud may be the virtualization of applications. Thus, the economies of scale kick in while still utilizing the infrastructure, without the need for additional capital outlay (Malcolm & Giunta, n.d.).

3.3 Hybrid Cloud

The hybrid model may combine the best of the public and private cloud models. According to Hurwitz, Kaufman & Halper (2012), the hybrid model will become the standard model of the future. Thus, a company may use public cloud applications, while maintaining a private cloud within their control. For instance, standard cloud applications can be leveraged against the cost of desktop applications. Another clear advantage to the hybrid model is that the hybrid presents the entire organization as one platform.

4 BENEFITS AND RISKS

For organizations considering cloud computing, they must not only look at the benefits but also the risks involved. Many IT professionals have expressed doubts about the sustainability of cloud computing and the fact that it is growing too fast. This section looks briefly at both the benefits to the organization and the risks to that same organization.

4.1 Benefits of Cloud Computing

As mentioned previously, the most discussed benefit is that of economies of scale. Garrison, Kim & Wakefield (2012), postulate that the “IT expenses generally associated with developing, procuring, administrating, and maintaining in-house IT … can be shifted to the cloud.” Furthermore, they explain that the move to cloud computing allows the organization to redirect resources internally, providing a competitive advantage for the organization (Garrison, Kim & Wakefield, 2012). Other advantages mentioned in the literature besides the reduction of costs are scalability without the need to add hardware resources, fault tolerance and reliability, instant access no matter your location, the ability to deploy applications quickly, data recovery and business continuity (Garrison, Kim & Wakefield, 2012; Symantec, 2012)

4.2 Risks of Cloud Computing

Cloud computing is not all roses for the organization. Literature cites several risks to implementing cloud computing with the major risk being that of security. In a survey taken by Information Week (2009), eight risks were identified and are presented below:

1. Security defects in the technology
2. Unauthorized access to proprietary information
3. Unauthorized access to customer information
4. Application and/or system performance
5. Business viability of the provider
6. Business continuity or readiness of the provider
7. Basic maturity of the technology
8. Vendor lock-in

While this list is quite comprehensive, there may be more industry specific risks. For example, compliance issue for health care and financial institutions. Thus, each organization must take a hard look at each of the risks involved with this technology and be constantly vigilant in the quest to stay safe in the cloud (Winterberg, 2012).

5 CONCLUSION

This paper shows that the question is not whether to move to the cloud or not, the question is how much and which model to use. Even though there are risks involved, clear benefits in favor of cloud computing exist. In this paper, a basic understanding of cloud computing is provided to help answer the question of what the cloud really is and what are the potential benefits and risks to an organization.

6 REFERENCES


